

A scenic view of the Wellington harbor and city skyline. The water is a deep blue with gentle ripples. In the foreground, dark, jagged rocks are partially submerged. The city skyline is visible across the water, featuring various modern and older buildings. Behind the city, a large, green, forested hill rises under a blue sky with scattered white clouds.

Climate change mitigation in New Zealand – what is the role of new planted forests ?

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David Evison
Associate Professor, Forest Economics
School of Forestry
University of Canterbury

Planted forests have already demonstrated their utility for large scale carbon sequestration in New Zealand...

New Zealand's CO₂ equivalent emissions (M tonnes CO₂ eq), by sector, 2008 to 2012

New Zealand's agreed target for 2008 to 2012 (Kyoto CP1) was 302 million tonnes CO₂ eq.

Sector	MT CO ₂ eq					TOTAL
	2008	2009	2010	2011	2012	
Energy	34.582	31.741	31.624	31.222	32.121	161.290
Industrial processes	4.139	4.158	4.549	5.284	5.277	23.407
Solvent and other product use	0.031	0.028	0.031	0.028	0.034	0.152
Agriculture	33.156	33.368	33.560	34.213	35.020	169.317
Waste	3.857	3.806	3.727	3.646	3.596	18.632
SUM	75.764	73.101	73.491	74.393	76.048	372.798
Afforestation and reforestation	-17.364	-17.836	-18.193	-18.576	-18.965	-90.933
Deforestation	3.167	5.616	4.087	3.376	3.996	20.243
Total (Article 3.3)	-14.197	-12.220	-14.106	-15.200	-14.969	-70.691
NET EMISSIONS	61.567	60.881	59.385	59.194	61.079	302.107

Source: UNFCCC (2015)

Forestry – the hero of Kyoto CP1?

New forests are one only a few large-scale technologies available to sequester carbon

- Forestry is the only known and tested technology which sequesters large quantities of carbon from the atmosphere (Caldecott et al. 2015, Evison 2016).
- Some agricultural practices increase soil carbon but increasing soil carbon in New Zealand is unlikely with current agricultural trends towards intensification. Biochar can also sequester carbon, but not practiced or tested at an operational scale.
- Fast-growing plantation species will sequester carbon faster, and at lower cost, than other alternatives.
- Removal occurs as new forest grows and once the forest reaches a biological steady state, no further significant new sequestration occurs.
- These features have important implications for how planted forests should be used to reduce New Zealand's greenhouse gas emissions.

The appropriate way to use new forests is:

- Develop national goals for reducing gross emissions by changing technologies, infrastructure and patterns of use (potential actions have been identified by RSNZ and Globe-NZ, among others). The key elements of this are
 - A target reduction in gross emissions by a specific sector, with a date of achievement
 - Specific actions that will lead to the target being reached
- Use new planted forest to reach this target **earlier that it can otherwise be achieved**, and to further reduce emissions while new technologies (as yet unidentified) are discovered and implemented.
- Because the carbon sequestration from forests is “one-off” it should not be used to offset business as usual emissions.

Forestry should be an “accelerator” – get to a gross emissions target earlier

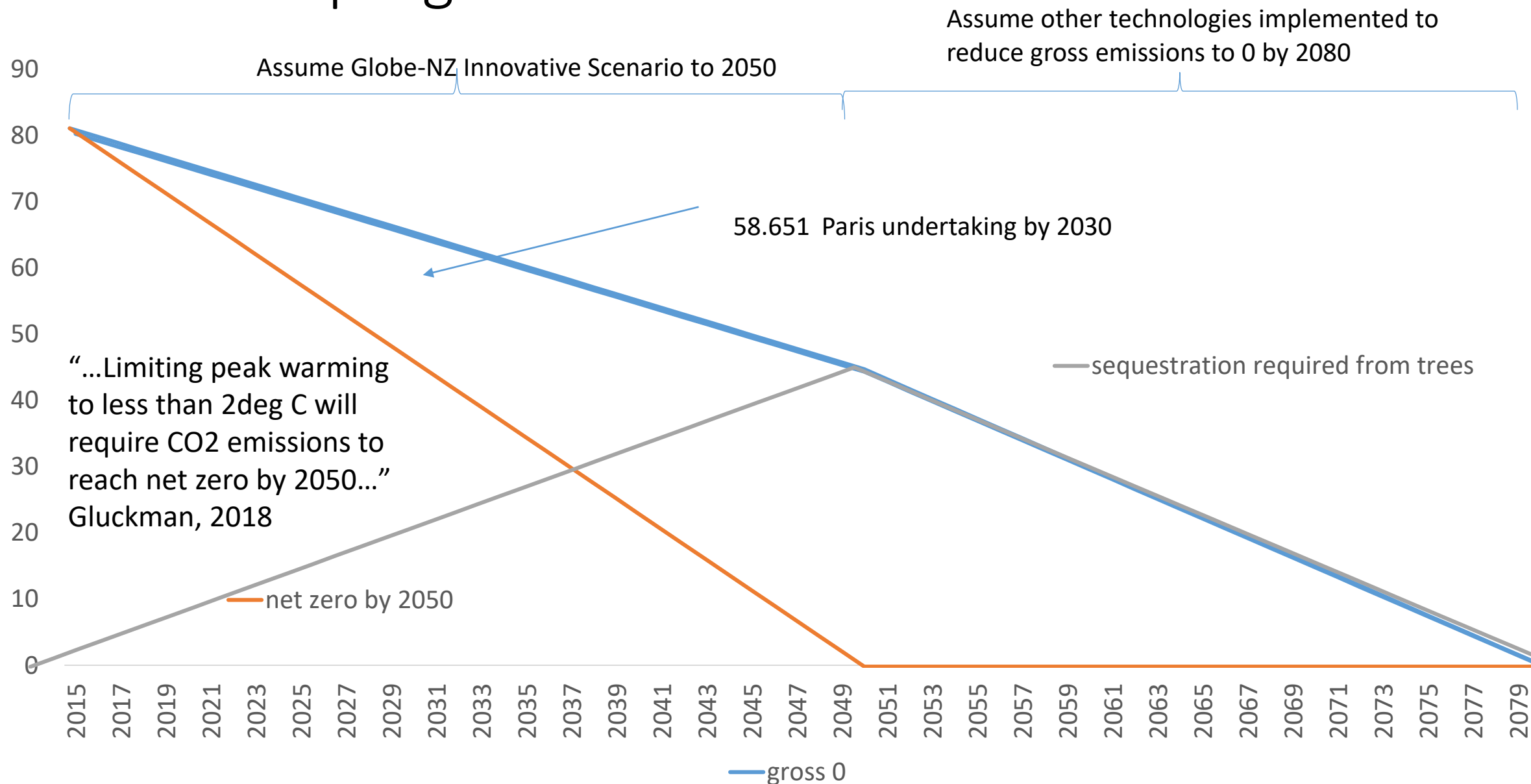
Globe-NZ Scenarios for emissions reduction

	Globe-NZ scenarios (Mt CO ₂ -e)				
			Off Track	Innovative	Resourceful
	1990	2014	2050	2050	2050
Energy	23.8	32.1	20.5	12.7	20.6
Industry	3.6	5.2	4.2	4.1	4.2
Agriculture	34.4	39.6	33.2	24.7	28.5
Waste	4.1	4.1	3.9	2.8	3.9
Gross	65.9	81	61.8	44.3	57.2
LULUCF	-28.9	-24.4	-11.5	-26.9	-36.4
Net	37	56.6	50.3	17.4	20.8

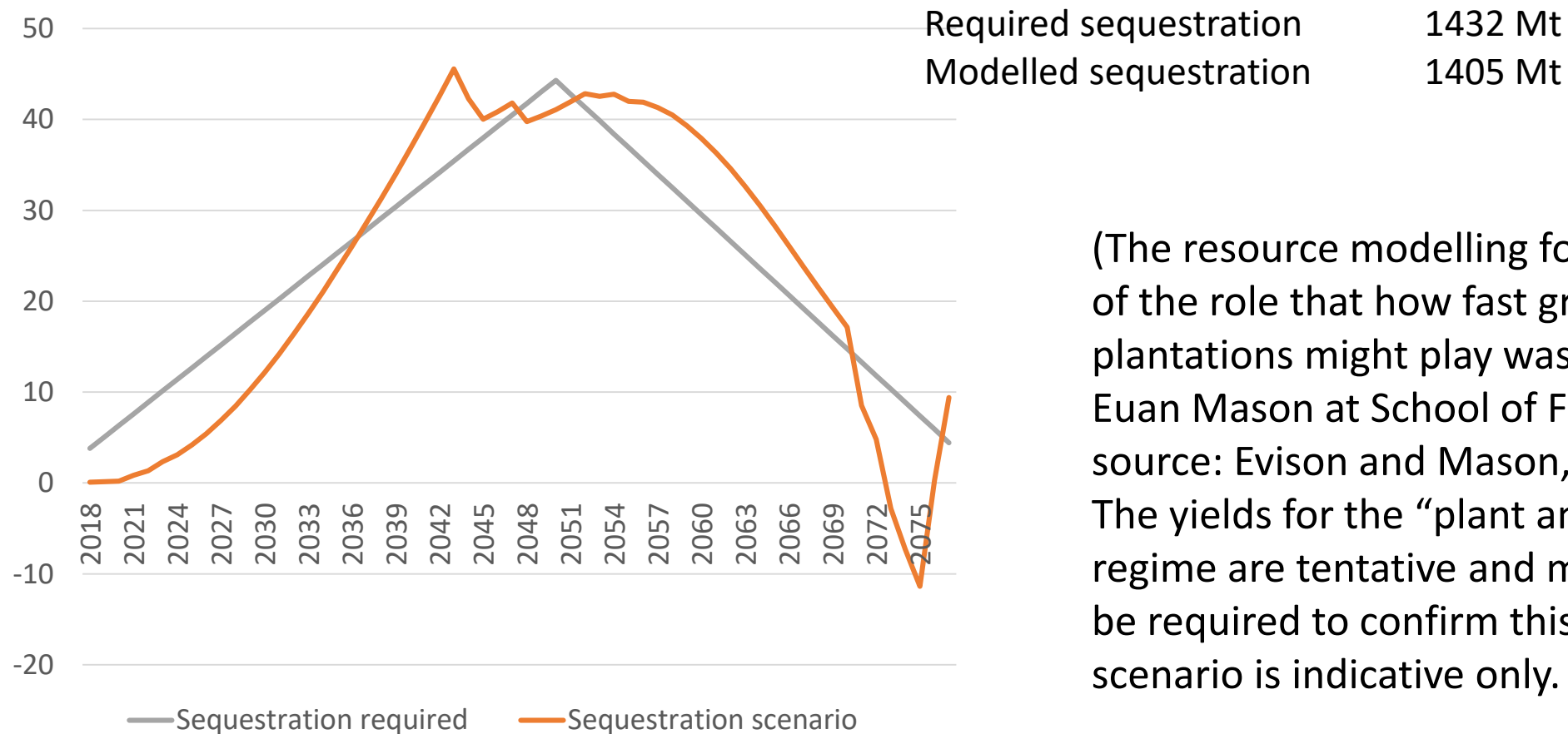
The Innovative Scenario, is the most ambitious (in terms of reductions in emissions by sector) of the three offered by Globe-NZ. We will take this scenario and show what additional undertakings can be made through the appropriate use of planted forests

Source: Vivid Economics, (2017)

Example of how to use forestry in an emissions-reduction programme

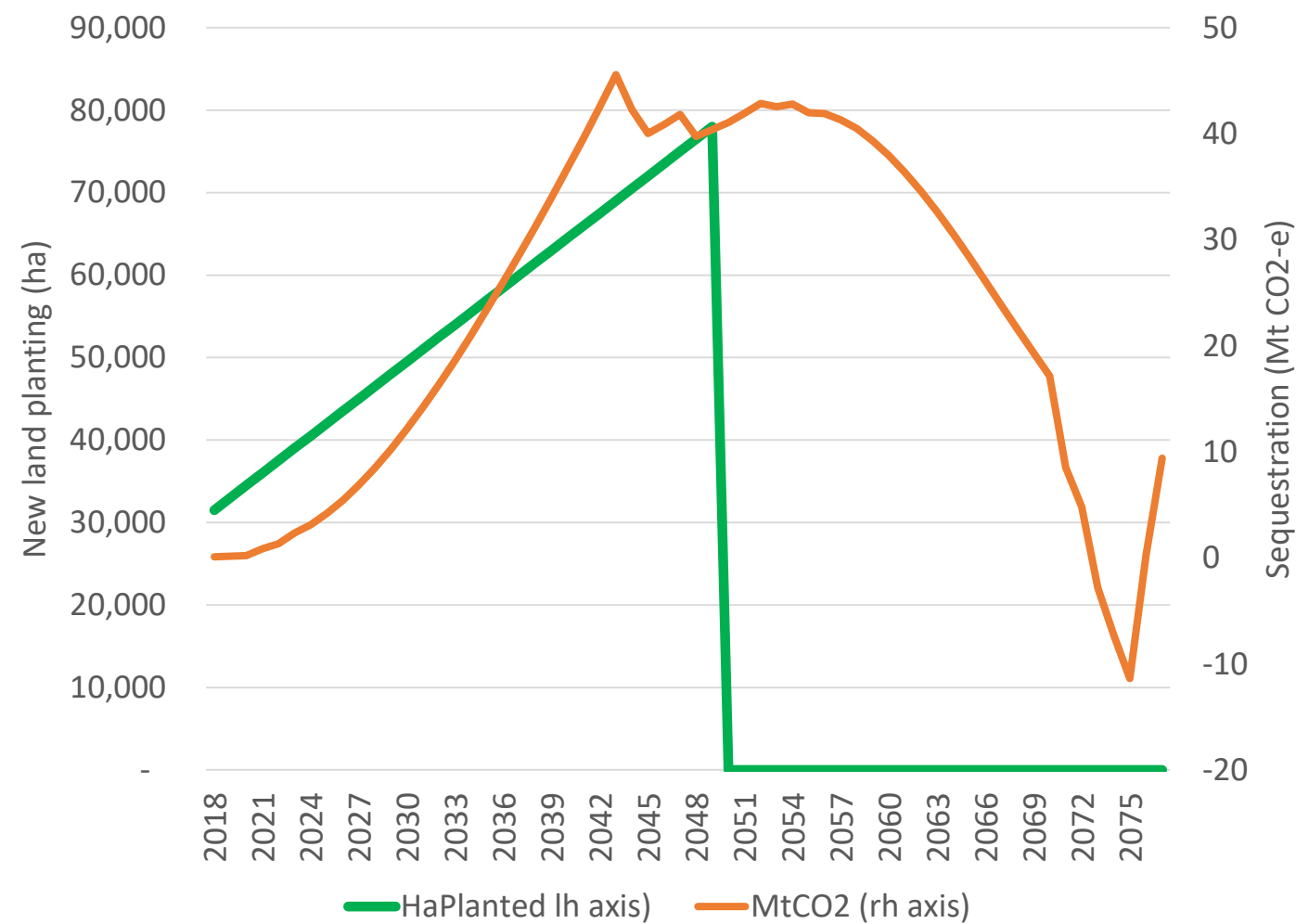


Net emissions to zero by 2050 can be achieved through implementation of Globe-NZ scenario 2 and planting new forest



(The resource modelling for this example of the role that how fast growing plantations might play was done by Prof Euan Mason at School of Forestry, source: Evison and Mason, 2017). The yields for the “plant and leave” regime are tentative and more work may be required to confirm this estimate. The scenario is indicative only.

New planting to achieve emissions reduction target



New forest area in 2050		
Timber	1,314,000	ha
Permanent	438,000	ha
TOTAL	1,752,000	ha

(This planting programme would get NZ to net zero by 2050, and would keep net emissions at zero for 30 years, until gross emissions reached zero in 2080)

Possible costs

(Same as
current AGS)

	ha	Cost (\$/ha)
Radiata pine, pruned, rotation 28 years	1,314,000	\$1,300
Radiata pine, plant, no harvest	438,000	\$3,000

- Under these assumptions planting the entire 1,752,000 ha would cost \$3.022 billion
- It is assumed that 1,314,000 ha of land would be planted for timber.
- 438,000 ha would be planted as permanent carbon stores.
- If projected gross emissions between 2018 and 2050 were taxed at \$1.58 per tonne, that would pay for the entire planting programme
- If an unpruned regime was selected (a more likely scenario) sequestration would be higher and the area required would be lower.
- Further work is needed to confirm the carbon sequestration yields and costs of a major forestry programme.

Benefits

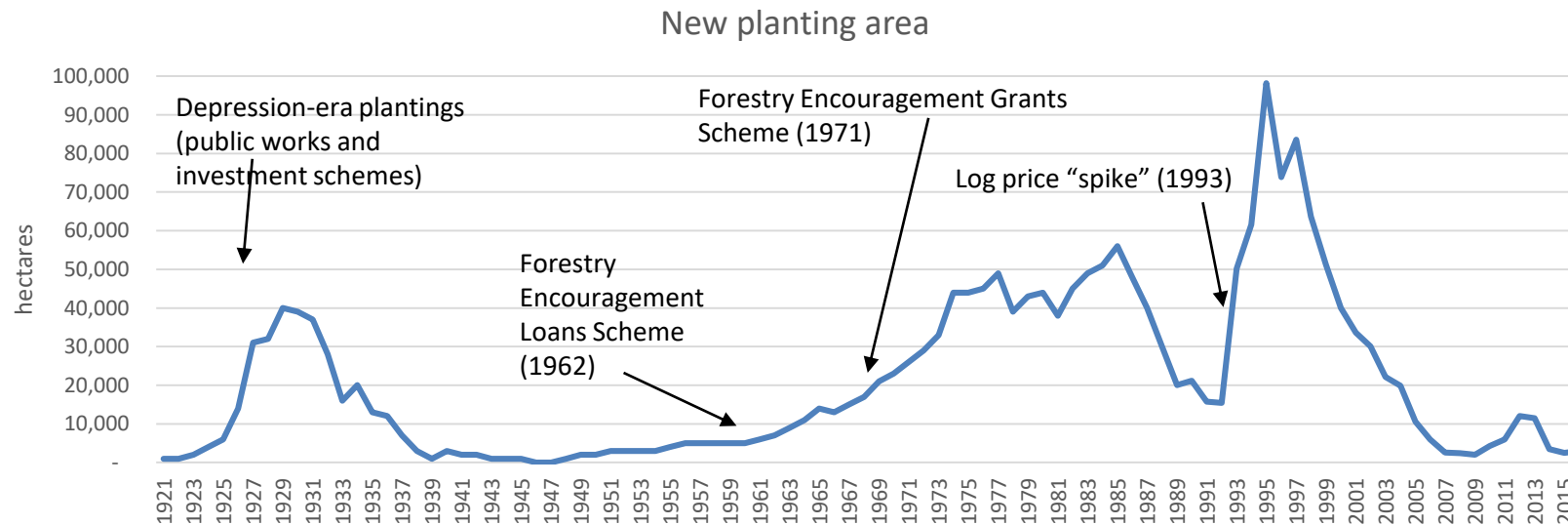
- A mechanism to meet challenging and meaningful climate targets
- A mechanism that is flexible in the sense that planting rates can be adjusted annually, depending on actual gross emissions
- Building a new low carbon footprint, low energy footprint industry (probably worth at least 5 billion per annum in export receipts), and a number of other environmental benefits.

Implications

- Is this feasible?
- What policy instruments are needed to make this happen?

Is a planting programme of this size feasible?

- Large but not without historical precedent
- Planting subsidies or improved profitability of forestry have stimulated large planting programmes in the past



Source: MPI, MoF, NZFS data

What did the ETS achieve up to 2012?

- No reduction in greenhouse gas emissions by polluters.
- Significant deforestation
- Very little new land planting
- Effective curb on changing land use for pre-1990 forests, when carbon prices are high. Conversely, incentive to deforest when carbon prices are low...
- Help with acquisition of 122 million international credits by the NZ government (no cost for those acquired through the ETS)

From the passing of the Climate Change Response Act in 2002 till 2012 (the end of Kyoto CP1), New Zealand experienced a net loss of 50,000 ha of planted forest. Up to 2012 a planting subsidy (AGS) led to 12,000 ha of new planting. The effectiveness of the AGS was limited by the funding allocated by government.



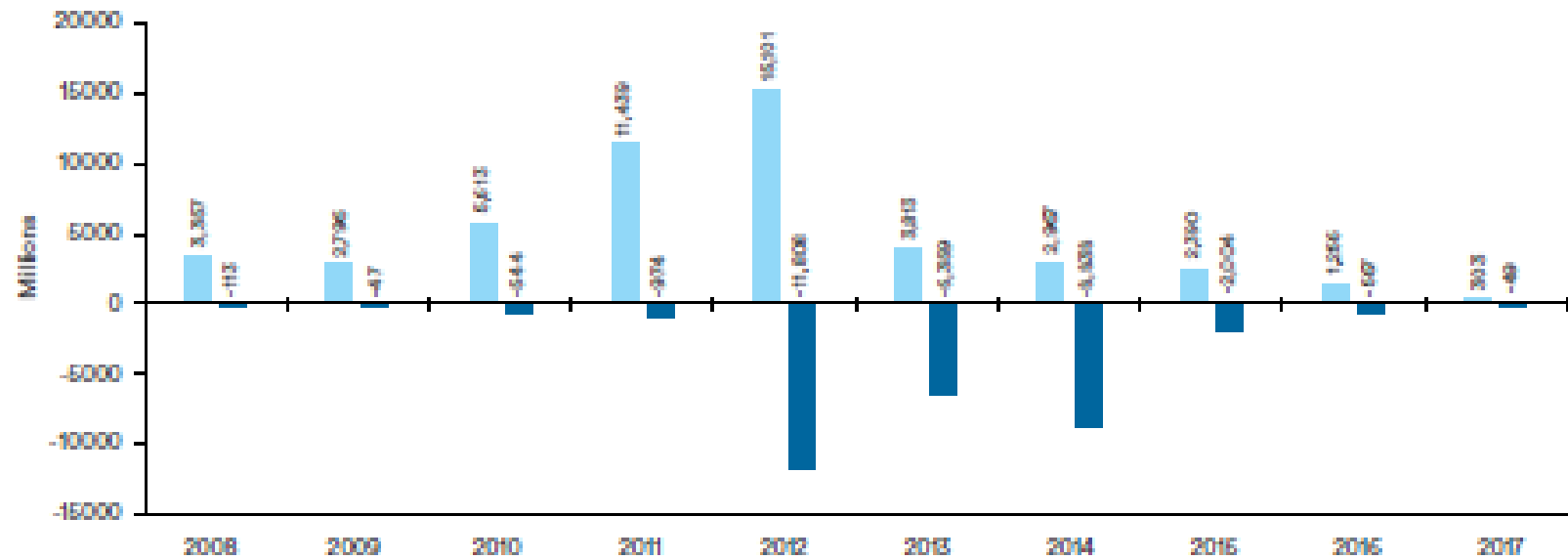
Source: Ministry for Primary Industries and the Ministry for the Environment

Source: EPA (2014)

FIGURE 4

Afforestation and deforestation reflected in the ETS for the period 2008-2017.

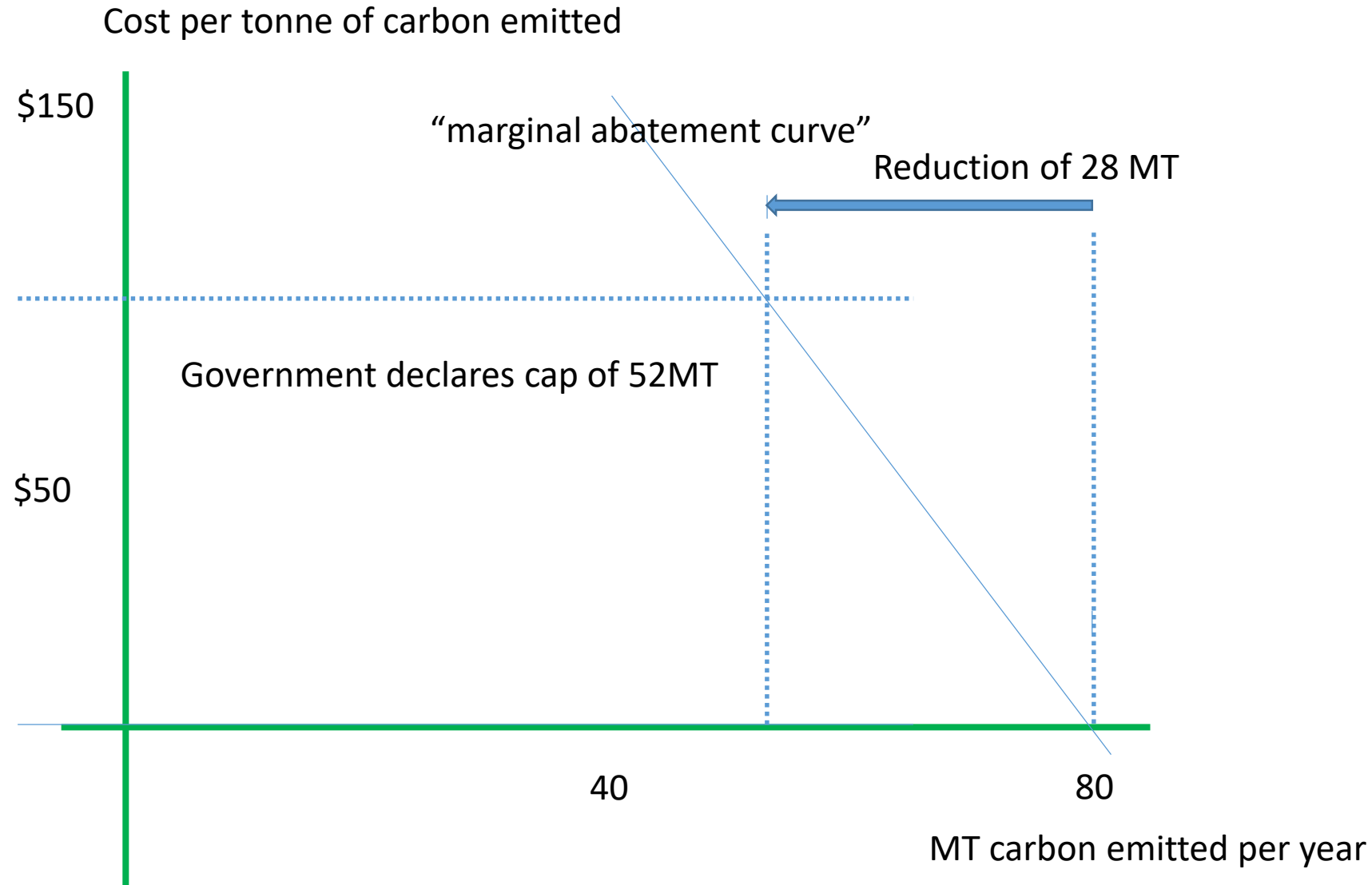
- Registered post-1989 forest land by year of establishment (Ha)
- Notified deforestation of pre-1990 forest land by each year (Ha)



Cap and trade and the NZ-ETS

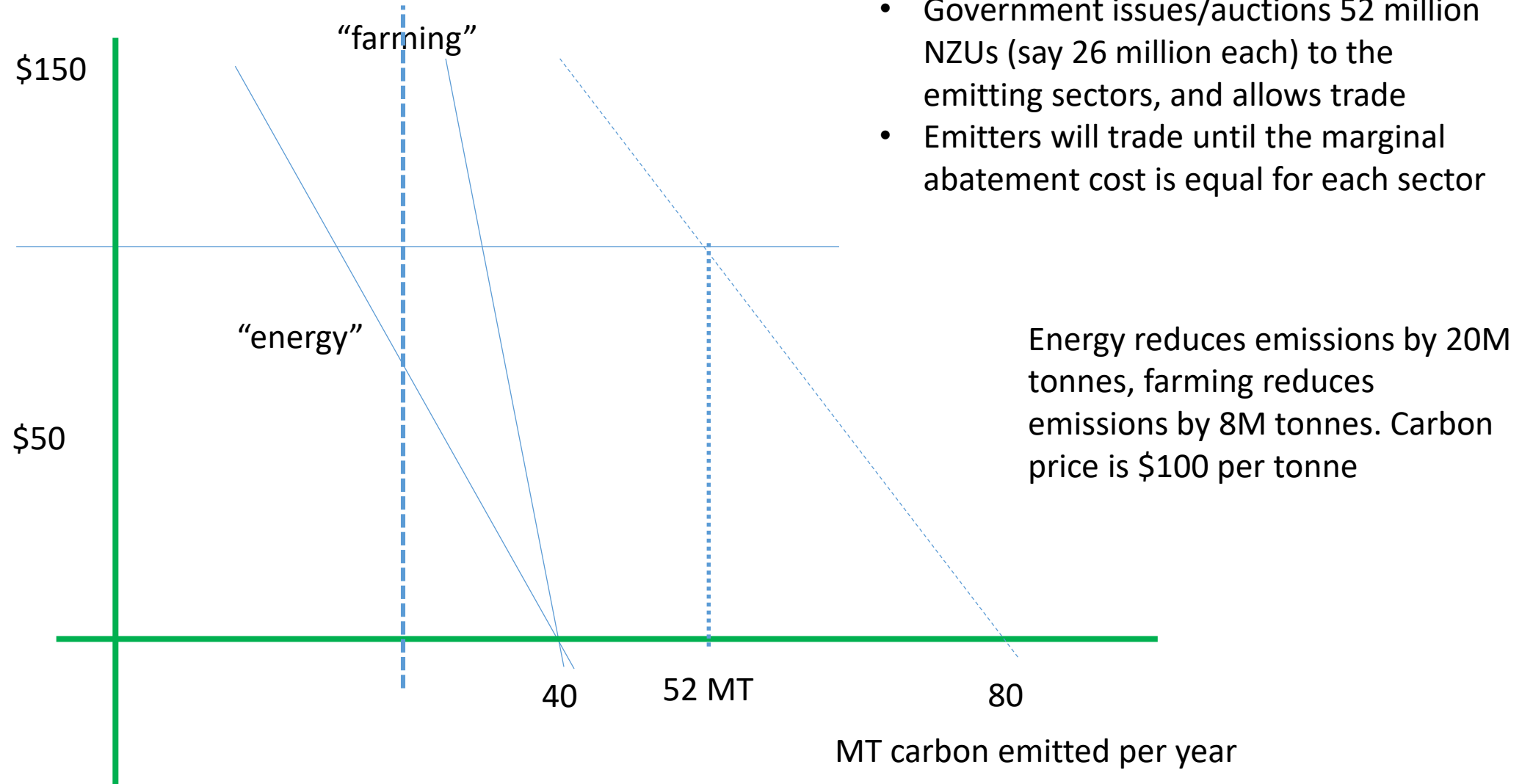
- Cap and trade schemes were devised (and in other parts of the world, have been implemented) to change behaviour of emitters.
- Should our cap and trade include a sector that sequesters carbon (forestry)?
- New Zealand is unique in the world in having included forestry in an emissions trading scheme
- There has been long-standing concern about the NZ ETS, for a variety of reasons, including the lack of a “cap” (see for example Bertram and Terry, 2010)

Implementation of a true cap and trade scheme



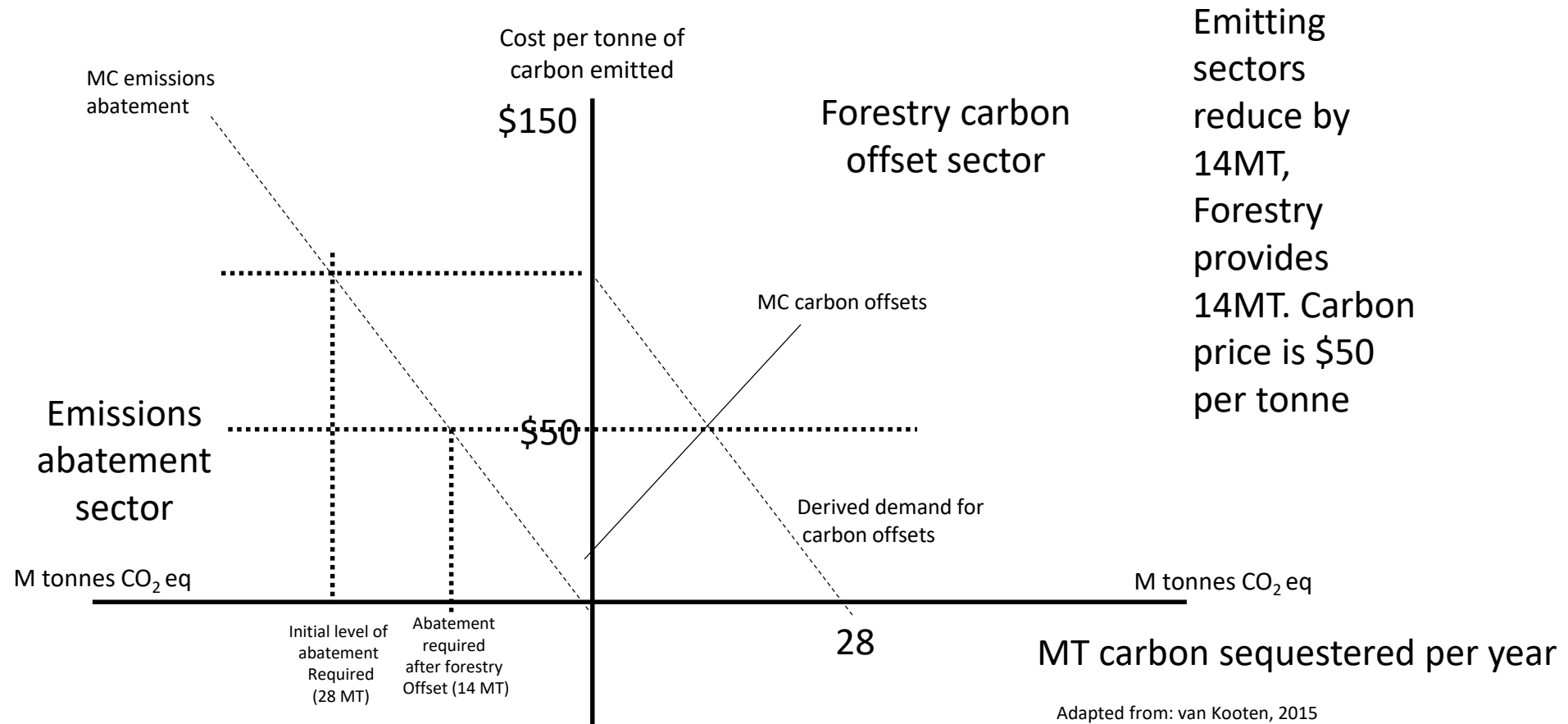
Response of sectors with differing marginal abatement costs

Cost per tonne of carbon emitted



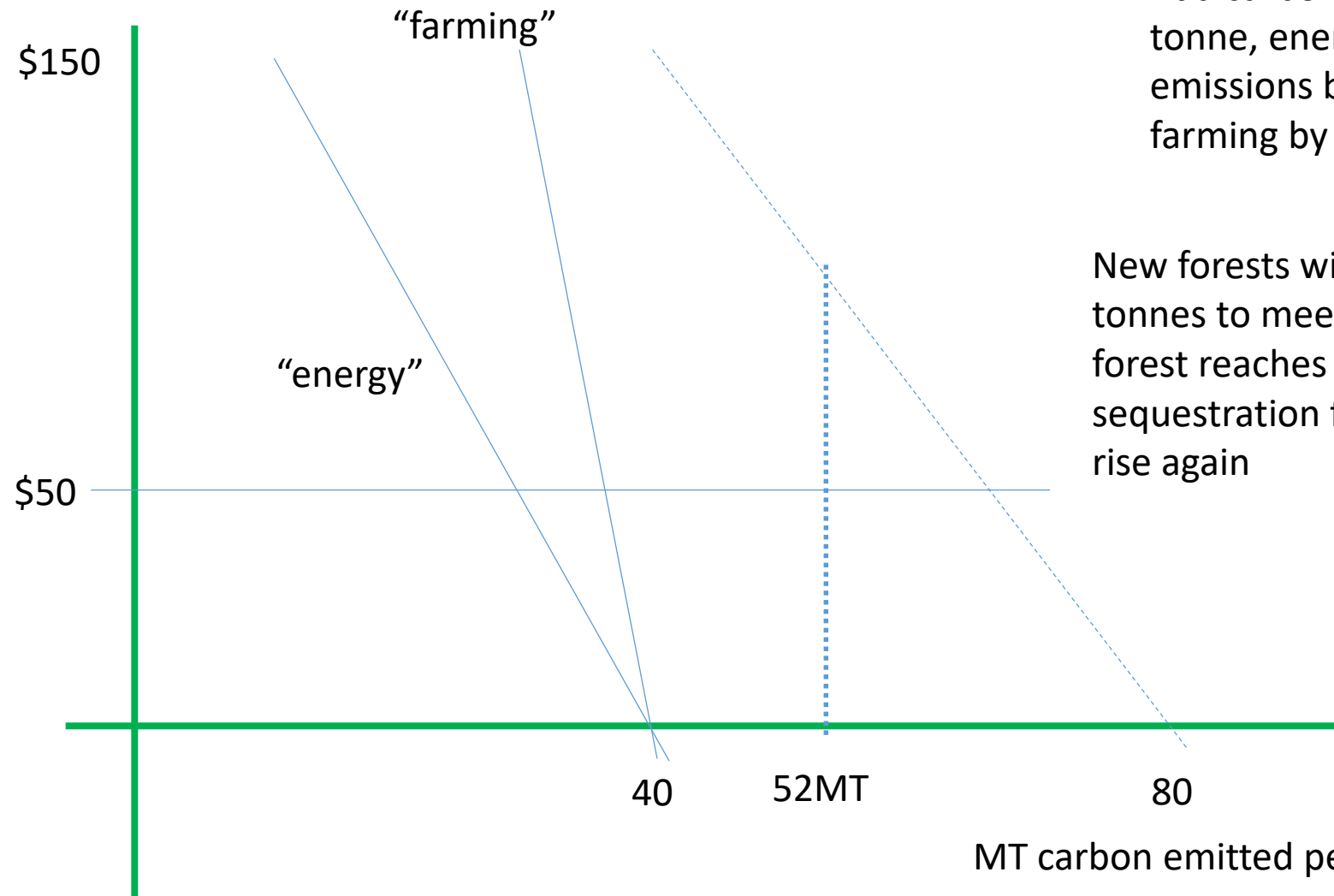
- Government issues/auctions 52 million NZUs (say 26 million each) to the emitting sectors, and allows trade
- Emitters will trade until the marginal abatement cost is equal for each sector

Including forestry in a cap and trade



Response of emitting sectors with forestry included in the NZ ETS

Cost per tonne of carbon emitted



At a carbon price of \$50 per tonne, energy reduces emissions by 10M tonnes, farming by 4M tonnes.

New forests will provide the other 14M tonnes to meet the cap, but when the forest reaches a biological steady state sequestration falls to 0, and net emissions rise again

Problem with including forestry in an ETS

- If sequestration from trees is included as a way of meeting the cap, the price of pollution permits will decline. Forestry credits in a cap and trade will lower the price of carbon and therefore reduce the incentive to invest in lower emissions technologies
- If the cap is on net emissions, and forestry is included, there is no certainty about the size of the cap. Emitters are therefore facing a moving target
- In principle, the cap determines how much New Zealand needs to reduce its emissions to meet national goals and aspirations
- It is not clear how the cap can perform this function if forestry credits are included.
- Forestry in the ETS just delays the inevitable need to reduce emissions (and results in a larger stock of greenhouse gases in the environment).
- The ETS would be more effective at reducing gross emissions if forestry was removed

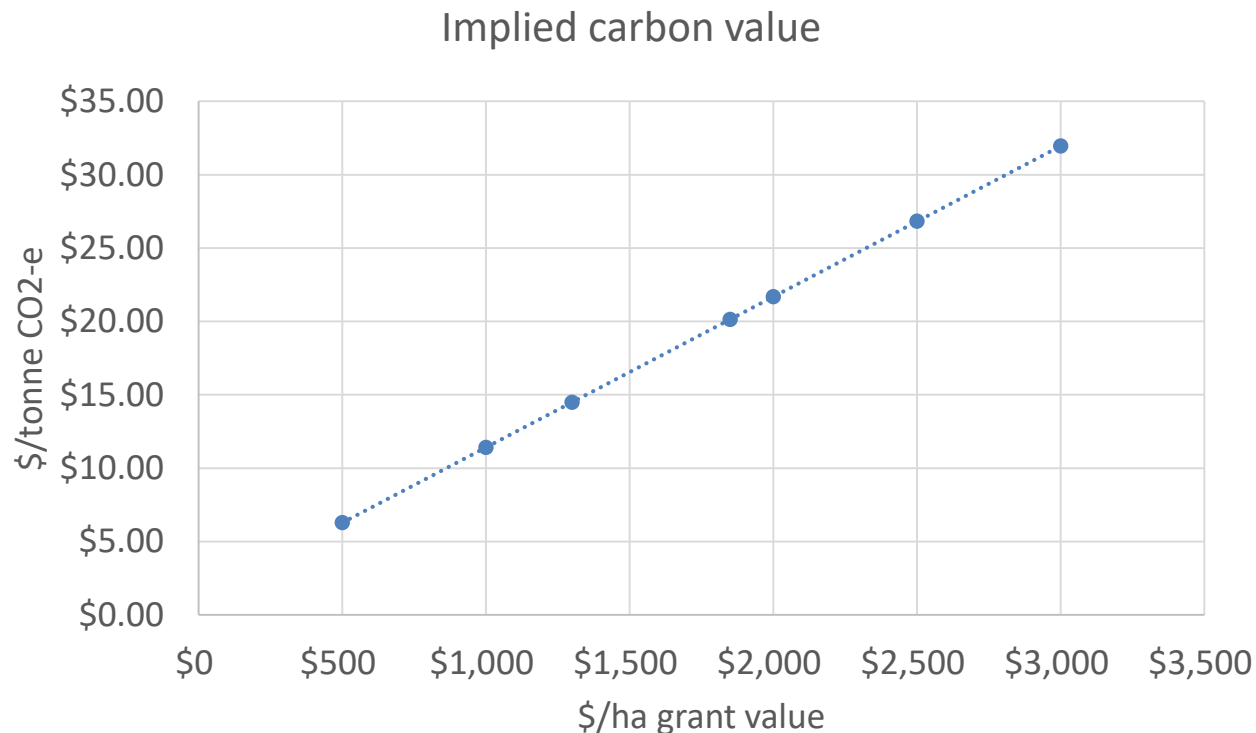
Can we encourage investment in new forests
with subsidies?

The AGS – what's good about it?

- Simple and easy to understand
- It works (12,000 ha planted) The amount of tree planting has been limited by the budget allocated
- Provides cash up front – good for land-rich cash-poor land-owners and more certainty than annual cash-flow
- The grant size could be adjusted to mirror changes in carbon price

The AGS can be seen as buying rights to the “safe” carbon

- Therefore you can put a grant value in terms of an implied carbon price. Using the MPI carbon look up table for BOP at 9% assuming \$15/ha/year admin costs



- At \$50 carbon price the implied value of the safe carbon (using MPI look up tables) is \$3,000 to \$6,000/ha
- At \$100 carbon price the implied value of \$6,000 to \$12,000
- These are equivalent to the potential grant values

What could we do differently?

- Talk about gross emissions targets, NOT net emissions targets
- If the emissions trading scheme is seen as the best policy instrument for meeting New Zealand climate change mitigation goals, use the ETS for emitting sectors and implement a hard cap, based on carbon budgets for emitting sectors
- Don't complicate the ETS, simplify it
- Use another policy instrument to encourage forestry planting. A subsidy would be much simpler than the ETS. There are indications it would be more effective also.
- Ensure objectives of new planting are clear. If the purpose is to sequester carbon and get to net zero by 2050, then focus on fast growing species, with the lowest costs of establishment and management

However, recent policy documents talk about....

- Net emissions targets
- “Getting the price signal right”
- Allowing international credits, continuing to include forestry in the ETS, and (potentially or effectively) not including some emitting sectors
- Adding significant complexity to a scheme that is already difficult to understand

Conclusions

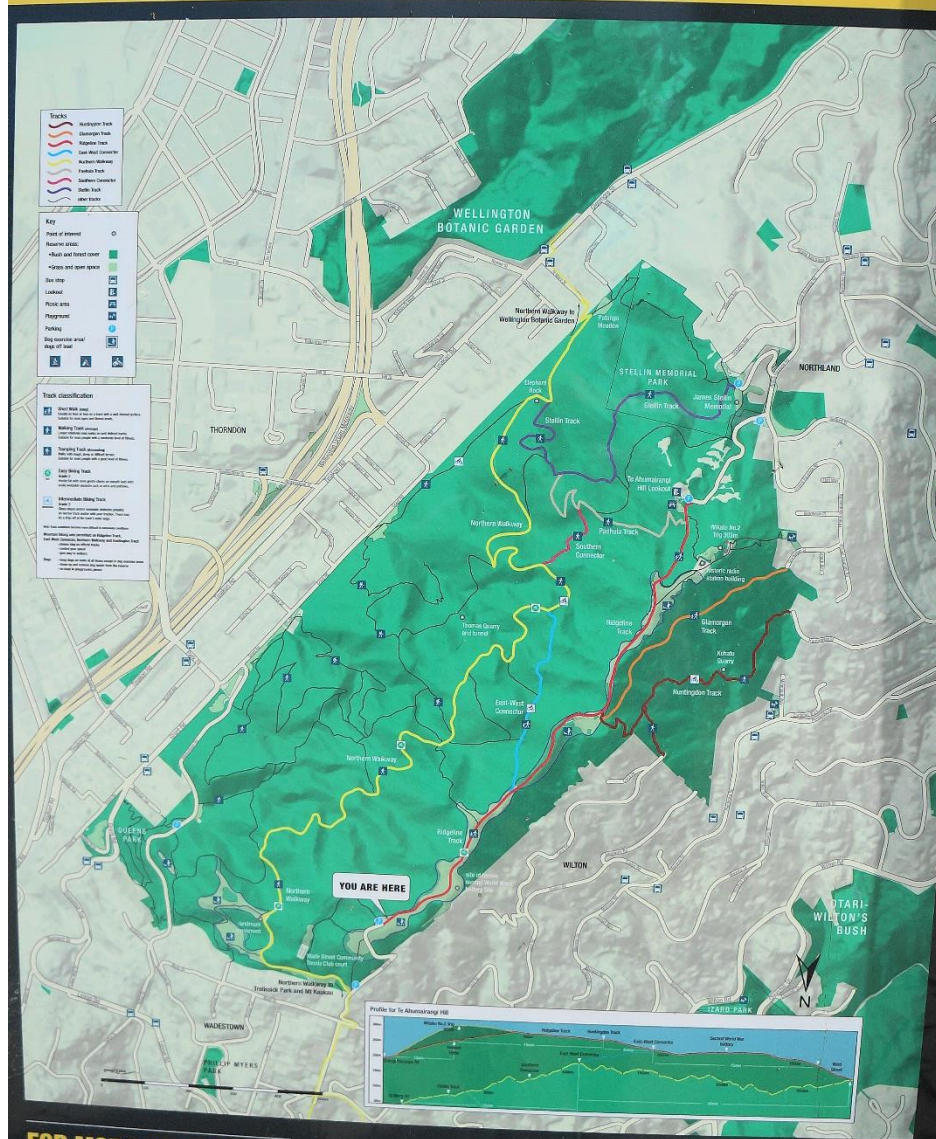
- There needs to be a target on gross emissions. What are the emitting sectors going to do to reduce their emissions?
- New forests can sequester large amounts of carbon cost-effectively. If you have a future target on gross emissions, you can use forestry to get you to the target sooner.
- Having a target on net emissions confounds two different processes for reducing greenhouse gas emissions
- Forestry has a very important role to play in mitigating New Zealand's greenhouse gas emissions, but current policy instruments are not encouraging the necessary investment for this to occur

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TE AHUMAIRANGI HILL – WELLINGTON TOWN BELT



FOR MORE INFORMATION
Ph 499 4444
Wellington.govt.nz

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